

Indonesian National Road Geotechnical Database (INROG) of Ministry of Public Works Indonesia

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Key words: web mapping, geotechnical

SUMMARY

Indonesia has 2770 national road link in 33 provinces from Nanggroe Aceh Darussalam Province to Papua Province. The mean of AADT (Annual Average Daily Traffic) in 2007-2008 of the road link is 7948. Each road, generally build in typical soil problem, for example soft soil, expansive soil, and volcanic soil. This typical soil problem is a part of geotechnical problem in road development in Indonesia. More than 20 geotechnical problem takes place in National Road link per year.

To mining the data of geotechnical problem occur in the road, we try to make Indonesian National Road Geotechnical Database (INROG). The objectives of the database is for eternal data mining of geotechnical data and geotechnical problem arise in road development, so consultant, contractor, owner and public can access those data for getting information. INROG is web mapping application, use PHP, java script, MYSQL, and Google Map API. In this paper, we describe the concept and process of making INROG.

INTISARI

Indonesia memiliki 2770 ruas jalan dengan status nasional yang tersebar di 33 propinsi, mulai dari Nanggore Aceh Darussalam sampai dengan Papua. Nilai rata-rata dari AADT pada setiap ruas jalan adalah 7948. Setiap ruas jalan pada umumnya dibangun pada tanah yang memiliki tipikal masalah seperti tanah lunak, tanah ekspansif, dan tanah vulkanik. Lebih dari 20 masalah yang berhubungan dengan geoteknik terjadi pada ruas jalan nasional setiap tahunnya.

Untuk mengumpulkan data mengenai masalah kegeoteknikan, kami mencoba untuk membuat INROG (*Indonesian National Road Geotechnical Database*). Tujuan dari aplikasi basis data ini adalah untuk pengumpulan data-data geoteknik dan masalahnya pada pembangunan jalan secara terus menerus sehingga konsultan, kontraktor, pemilik pekerjaan, dan masyarakat dapat mengakses data-datanya untuk mendapatkan informasi. INROG adalah aplikasi web mapping dengan menggunakan PHP, javascript, MYSQL, dan Google Map API

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1. INTRODUCTION

1.1 Background

Indonesia has 2770 national road link spread in 33 provinces with the total length is 4920.1 KM. Those national roads spread from Nanggroe Aceh Darussalam to Papua Province. The mean of AADT (Annual Average Daily Traffic) in 2007-2008 of the road link is 7948.

Each road, generally build in typical soil problem, for example : Soft soil problem in Pantura Road. Expansive soil problem in Timor, Nusa Tenggara Timur known as Bobonaro Clay, covering at least 60% of Timor Island (1). Land slide usually occur in volcanic soil. This soil swells from Sumatera, Jawa, Sulawesi, and Maluku. More than geotechnical problem takes place in national road link per year. Those problems agitate transportation network in delivering goods and services.

There's no database to mining all geotechnical problem in Indonesian National Road. As we know, data and bank data is one of the elements in decision making. We try to make web mapping application called INROG-Indonesian National Road Geotechnical Database

1.2 Objectives

- To mining geotechnical problem occur in the national road
- To mining geotechnical data
- To give user geotechnical information via internet
- To give one of parameter in decision support

2. INROG CONCEPT

INROG concept illustrate in Figure 1.

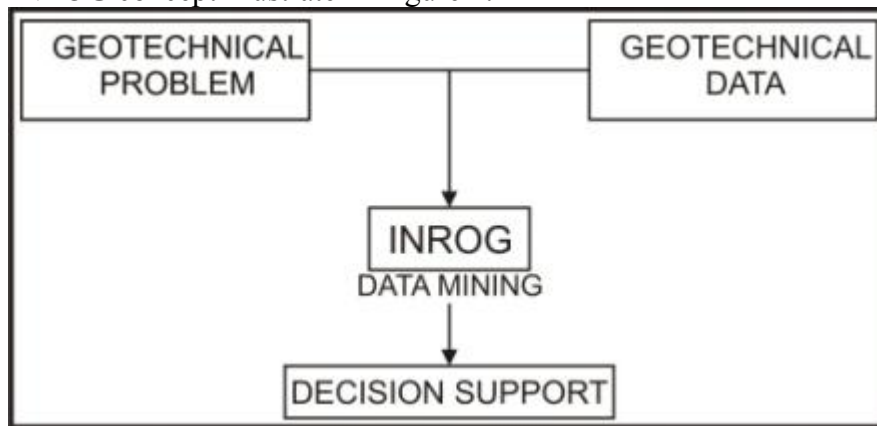


Figure 1 INROG Concept

INROG concept is data mining of geotechnical problem and geotechnical data that can give a support of decision making in geotechnical problem solving. User can see, download, and upload geotechnical problem and data via internet.

2.1 Geotechnical Problem and Data

Geotechnical problem occur in national road typically divide in 2 parts:

1. Base soil
2. Land slide

Sub base problem commonly occur in soft soil and expansive soil. In our office we call them problematic soil. Land slide occur in hilly terrain and high embankment of the road.

We predict this position of problematic soil/landslide will make some pattern of soil if we have their position (longitude and longitude). In our GIS system, problematic soil and slide usually stays on Alluvium and Tuff. If we have a system that mining all geotechnical problems, we can give support for decision making to solve the problem. Figure 2 describe the important of data mining of geotechnical problem and geotechnical data.

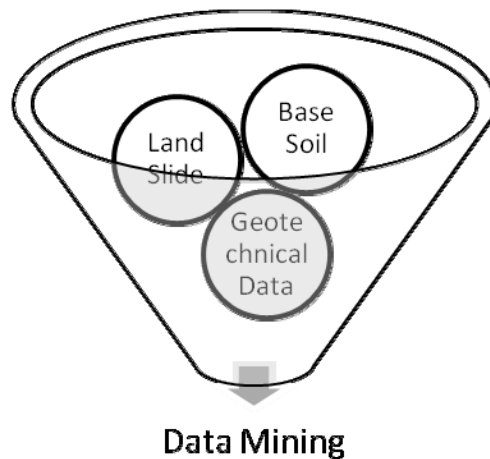


Figure 2 Geotechnical Problem and Data Mining

Geotechnical data split in 2 parts:

1. Main data : Geotechnical Investigation and laboratory data, for example: Bore log, DCP, slope and landslide survey, road material survey, geotechnical problem survey, index properties, and engineering properties,
2. Supporting Data : Geology, earthquake, rainfall, KM post, road map, and geotechnical project location

2.2 Data Mining

Data mining is information extraction or important patterns from the data in master database (2). Data mining in geotechnical problem is not just collect the problem, but closed to geotechnical information discovery, for example: damaged road caused by geotechnical problem patterns in Seram Island, Maluku Province as we see in Figure 3.

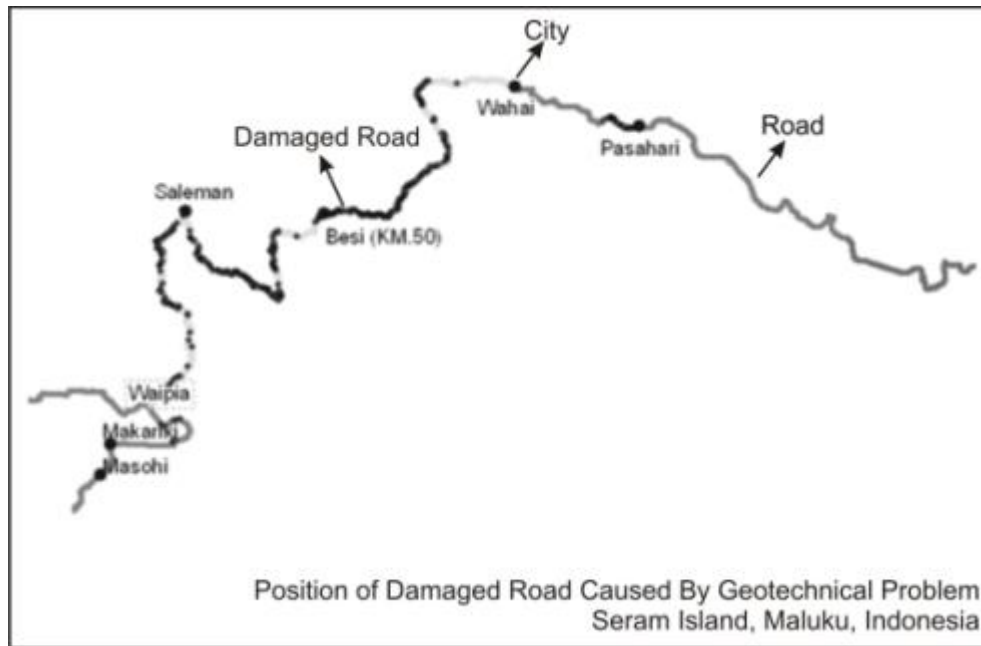


Figure 3 Damaged Road caused by Geotechnical Problem

3. THE MAKING OF INROG

The process of INROG's making are:

1. Making of data structure
2. Code Programming

3.1 Data Structure

INROG is web mapping application that just delivered map on the World Wide Web. Map means geotechnical data and problem. The types of map of this are point, line, and polygon as described in Table 1.

Table 1 The type of Map(Geotechnical Data and Problem)

No	Data/Map	Type	Attribute
1	Land slide	Point	Province, road link, latitude, longitude, land slide type, slope type, land slide material, caused by, impact, photo, time
2	Natural slope	Point	Province, roadlink, latitude, longitude, slope material, vegetation, slope height, slope angle, photo, time
3	Man Made slope	Point	Province, roadlink, latitude, longitude, type of man made slope, slope material, trap, trap height, trap engle, structure, photo, time
4	Road Material	Point	Province, roadlink, latitude, longitude, time, photo, owner, access road, gradation, abration, LL, PL, PI, top soil, volume, product
5	Earthquake	Point	Latitude, longitude, magnitude, time
6	Bore	Point	Name, latitude, longitude, elevation, sample, depth, bor master, water level, photo, link to laboratory data
7	DCP	Point	Name, latitude, longitude, elevation, depth, qc maximum
8	Inclinometer	Point	Name, latitude, longitude, depth, link to data
9	Piezometer	Point	Name, latitude, longitude, link to data
10	Extensometer	Point	Name, latitude, longitude, link to data
11	Control Point	Point	Name, latitude, longitude, elevation
12	Rain Gauge	Point	Name, latitude, longitude, link to data
13	Geotechnical Project	Point	Name, latitude, longitude, report
14	KM Post	Point	Name, latitude, longitude
15	Public work office	Point	Name, latitude, longitude
16	Police office	Point	Name, latitude, longitude
17	Damage Road	Point	Latitude, longitude
18	SMS info	Point	Latitude, longitude, description
19	Road	Line	Province, roadlink, length, geotechnical problem, land slide, road material, natural slope, man made slope, geology formation, rock type
20	Geology Structure	Line	-
21	Province	Polygon	Name, Area, population, total length of national road
22	Rainfall Prediction	Polygon	Amount
23	Geology Formation	Polygon	Code,formation, description

There're 23 type data It has related to geotechnical problem solving. For example : Requirement of bor data information site area of embankment design or to predict slip circle on land slide analysis. These data have their own structure. The structure describe in column of the table of data and type of data. It used in MYSQL as we see in Figure 4, data structure of land slide.

Column Name	Datatype	NOT NULL	AUTO INCR	Flags
kodelongsoran	INTEGER	✓	✓	☒ UNSIGNED
namaprop	VARCHAR(45)	✓		☐ BINARY
linkid	VARCHAR(45)	✓		☐ BINARY
lintang	DECIMAL	✓		☐ UNSIGNED
bujur	DECIMAL	✓		☐ UNSIGNED
tipelongsor	VARCHAR(45)	✓		☐ BINARY
materialongsor	VARCHAR(45)	✓		☐ BINARY
penyebab	BLOB	✓		
pengaruh	BLOB	✓		
linkfoto	VARCHAR(100)	✓		☐ BINARY

Figure 4 Data structure in MYSQL

3.2 Code Programming

The main page of INROG has 3 menus:

1. *Viewer menu*, user can see the data and map
2. *Download menu*, user can download data and use in another application (google earth, mapwindows, mapinfo, global mapper, etc)
3. *Update menu*, user can update geotechnical data.

Code programming for viewer menu developed by PHP, java script, MYSQL, and Google Map API. Example of viewer menu code for INROG:

```
<script
src="http://maps.google.com/maps?file=api&v=2&key=ABQIAAAANslsXzF_ijrl3NsOW8cFRxS2_kZ
aDxJcfT23ALtfDN_nyzZacxTIN3cyVB_4j6qLR_EQWBP_T_WSKw" type="text/javascript"></script>
<script src="js/koneksi_kuari.php" type="text/javascript">
</script>
<script src="js/koneksi_sdms.php" type="text/javascript">
</script>
<script src="js/kuari.js" type="text/javascript">
</script>
```

Code programming for download menu developed by PHP and MYSQL. It just table on the web containing the geotechnical data (spreadsheet data, kml/kmz data, shp data, and pdf data)

Code programming for update menu developed by PHP and MYSQL. User can fill the update form of geotecahnicla data. For example: if user known the location of land slide, user can fill the landslide form.

4. CONCLUSION

- INROG concept is data mining of geotechnical problem and geotechnical data that can give a support of decision making in geotechnical problem solving. User can see, download, and upload geotechnical problem and data via internet.
- INROG is web mapping application containing geotechnical data and geotechnical problem
- INROG developed by PHP, MYSQL, java script, and Google Map API.
- It necessary to make an online tool for INROG benefits evaluating.

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BIOGRAPHICAL NOTES

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